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A few Notes on the Pathology and Treatment of Fever.

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WE have for so long been taught, and have with such unquestioning faith received the doctrine that "Fever is to be defined as a grave morbid condition, caused by the action of a poison on the blood, and through this on every tissue of the body," that it is with very great hesitation I offer the following notes, in which I venture to depart somewhat from the beaten track, and to ascribe that condition of the system known as 'Fever,' to a different cause. It appears to me, however, that we should arrive at a much more satisfactory pathology, and obtain more correct indications of treatment for fever, if we looked for its origin to the nervous system, rather than to the circulatory. It is chiefly through watching fevers and allied disorders in this country that I have arrived at the above conclusion, and I am now of opinion that the cause of fever is to be found in deranged action of the sympathetic system. That the blood does almost immediately become poisoned is unquestionable, but it is a secondary occurrence, and consequent on abnormal action of the ganglionic system of nerves.

Our acquaintance with the anatomy, wide distribution, and physiology of the sympathetic, will leave little difficulty to be encountered in assigning various causes which may lead to its irregular action: heat, cold, fatigue, hunger, thirst, exposure, a too dry atmosphere, or a too moist one, an error in diet, disease of an organ, &c., &c., all and each play their parts in giving rise to irritation and abnormal action of this system of nerves, with fever as a result. We have also been taught that "nervous depression" is one of the earliest symptoms of fever, but I think such depression may be shown to be secondary, and that exaltation, especially of the sympathetic system, is more correctly entitled to rank among the very early symptoms. I shall here proceed to state what appears to me to be the pathology of fever as deduced from anatomy and physiology, and to consider some of the various phenomena which present themselves as symptoms during an attack.

First, we have irritation of the sympathetic from various causes, the most common in this country being, perhaps, exposure to the sun or hot dry winds; this irritation produces disordered secretion, excretion, and derangement of the vital functions generally, giving rise in the patient to vague premonitory symptoms, such as langour, headache, nausea, pains in the nucha and back, and in fact, to the general feeling of *malaise* which ushers in the disease, and which feeling is soon followed or increased by slight chilliness, which goes on to shivering. It will be noticed that pains and distress are chiefly referred to the various seats of ganglionic centres, but it is more important to pay attention to the shivering. When the chilliness first sets in, if we examine the patient with a thermometer, we shall find a real diminution in temperature, although in the cold stage of ague we find that the temperature is really increased; but this we shall consider afterwards. Now, what is the cause of this fall in temperature? I take it to be the following. The sympathetic being in a state of irritation, acting on the capillaries of the skin, causes them to contract. The capillaries, we must recollect, are in no way directly influenced by the cerebro-spinal system (Carpenter), so that their influence must be derived from the ganglionic. This contraction is, however, insufficient altogether to account for the diminution in temperature; and it is while considering the function of secretion that we shall find the full explanation.

Presiding as the sympathetic does, over the so-called vital functions of the body, as we might expect, we find secretion and excretion disturbed by the irritation taking place in the presiding force. Prominent among these deranged functions, is that of the skin. The sweat glands, with their spiral efferent vessels, owe their nervous supply to the same source as the capillaries; and being acted on in like manner, the secretion of watery matter, salts, &c. from the blood, and excretion by the skin, is either entirely checked, or at least greatly modified, and it is owing to this, and the checking of other secretions, that the fall in temperature is principally due; *the capillaries being contracted, the ordinary quantity of aerated blood is no longer offered to the secreting surfaces, and therefore the oxygenating process is greatly interfered with, and a corresponding* *diminution of temperature is the consequence.* This state of things does not, however, last long, and we are suddenly called upon to explain the very opposite condition of affairs; even while the patient is shivering, as if from cold, and while he complains much of cold, if we now examine him with the thermometer, we shall find a rise in temperature, which will go on increasing, it may be, for days. The various organs of the body, muscles, &c., begin slowly to disintegrate, owing to modification of their nervous supply. This disintegration it is, together with the presence of the debris in the blood undergoing oxygenation, that is the chief cause of the increase of heat. The pulse is increased in frequency and force, and is due to this same irritation of the sympathetic, acting both through the cardiac plexuses and the ganglia in the substance of the heart, demonstrated by Remak, and since shown by Lee to exist in large numbers. The arteries, being contracted by the action of the sympathetic (which is, as it were, in a state of tonic spasm), while the same quantity of blood is propelled with increased force through them, give to the pulse the hard jerking character so frequently felt during the onset of fever. The blood at this stage is rapidly becoming poisoned, both from the disintegrated matters which are finding their way into the blood, and from the non-elimination of certain constituents, owing to their non-secretion by the glands, whose function has been impaired.

In order to appreciate the mischief now at work, let us glance for a minute at the excretory action of the skin in health, which, under the above circumstances, has become nearly suspended. Sequin states the cutaneous exhalation to be about 11 grs. per minute; Valentine lays it down at 11·744 grs., or about 2½ lbs. per diem. When we remember the chemical composition of the perspiration, &c., we can easily comprehend how quickly the blood will become contaminated by checked secretion, and we all know how rapidly a frog dies if the skin be covered with a varnish, by preventing cutaneous excretion. But it is not only the function of the skin which is checked, the kidney, liver, spleen, &c. all take on modified action; thus, in some severe febrile affections, we get suppression of urine, in others jaundice and irregular action of the bowels. The behaviour of these organs, however, cannot be as readily watched as that of the skin under the conditions we are considering, and it is to the latter we are so greatly indebted for indications of treatment.

The stupor and coma which arise during fevers are to be accounted for, also, by reason of the capillaries having become contracted, thus interfering with the elective function of the brain tissue. That the capillaries of the brain do contract under irritation of the sympathetic, Dr. Hammond has demonstrated by means of the ophthalmoscope, the vessels being seen to contract during the passage of a galvanic current. In the brain, although the capillaries are very small, they are less numerous, and the meshes of the net-work are wider than in some other organs (Kirkes); and as these meshes or interspaces become widened by contraction of the capillaries, so is the supply of oxygen removed from the elective force of the tissues; moreover, since the circulation in the capillaries so greatly depends on the elective and secretive action of tissue (Carpenter, Kirkes), the motion of the blood through them becomes slower, giving rise to congestions, through deprivation of perhaps its chief source of motion. This same state of things, existing in other organs, the oxygen which would have been used in the normal economy for the oxidation of healthy tissues, is seized upon by the débris of various substances now finding its way into the blood, and being used for oxidizing it, increases the temperature. In the lungs a slightly different condition exists; the blood in the capillaries being in turn removed somewhat from the oxygen inhaled, is no longer thoroughly aerated, while the slow movement through the capillaries prevents even that portion of the venous blood, which can obtain a sufficient quantity of oxygen, completely to aerate it, from passing on with sufficient rapidity, to counterbalance the evil at work throughout the system. We can now distinctly observe "the action of a poison on the blood" as stated in the ordinary definitions of fever, but not the poison intended to be expressed in these definitions, viz., a "specific poison" or "malaria" (that convenient word which is intended vaguely to express so much, but which, as far as demonstration has gone, has never been proved to be more than a word). Up to the present, I have attempted to show how most of the prominent symptoms of fever can be accounted for by irritation of the sympathetic, and shall not lengthen these notes by taking up in detail the lesser points, all of which are, however, easily referable to the same cause; but I shall pass on to watch the general and gradual changes which take place, and the direction of the efforts of nature towards crises and health.

I have before stated that I believe the sympathetic is thrown into a kind of "tonic spasm," and the first step towards improvement is in relaxation of this spasm.

Through exhaustion of irritability, relaxation after a time sets in; coincident with this, the secretions gradually take place, and, owing to the condition of the blood, in increased quantity. In fact, the opposite condition (relaxation) of the sympathetic being present, exactly an opposite condition of affairs is the result. The skin, which felt like a piece of brown paper through contraction of involuntary muscles and dryness, now becomes moist, and at length profuse perspiration takes place. This relief to the system through the skin is simultaneous, we may presume, with relief afforded by the various secretory and excretory structures throughout the body; the urine, which was diminished, or may have been suppressed, is now increased in quantity; while also there may be a tendency to diarrhœa. The pulse loses its hard jerking character, and although still full and bounding, is soft and compressible; the headache (often described as though a cord were tied tightly round the forehead) also diminishes, and the system generally assumes somewhat of its normal condition. This "crisis" may prove the end of the attack, as in ordinary simple fever in England; or the sympathetic, having recovered its tone after a time, and the irritation being again at work, we have a second or third paroxysm, and so on, as in the intermittent and remittent forms. These fevers I consider to vary in degree only, their origin being the same, their symptoms varying only in degree, while the same treatment, as indicated by their pathology, applies to all. I observe that Dr. Murchison says, that "the common continued fever, the ardent fever, and the sun-fever of the tropics, are nothing more than severe forms of the simple fever or febricula of Britain," and I think he might have enlarged the list, as I doubt not will be done later. In sunstroke we have exactly the same class of symptoms in a severe form; in fatal cases, the patient dying with all the secretions locked up, the sympathetic never having relaxed from the time of its having received the irritating impression, so as to allow the system a chance of relief.

Not wishing to let these notes run to any length at present, I shall proceed to notice the indications for treatment.

If the theory that spasmodic action of the sympathetic is the true cause of fever, be correct, it is natural to suppose that whatever means will restore the normal condition of the ganglionic system, will at the same time remove the fever. Is it so? I think most undoubtedly it is so, and the means generally required are so simple, that I believe it is the chief reason they are so seldom employed. Of course, where a patient has had his constitution completely undermined by repeated and repeated attacks of fever, it is not only a case of fever that presents itself for treatment, but a complicated set of disorders, requiring disentanglement, and each its own class of remedies; but taking the ordinary fever as seen in this Presidency, the treatment of it, I think, embraces apparently very simple remedies. The chief of these (if not the only necessary ones) I consider to be the hot-bath and a stimulating emetic. I cannot claim any very lengthened period of service in this country, but so far as this Presidency is concerned, at none of the stations where I have been, including Madras, Bellary, Ramandroog, Bangalore, Trichonopoly, have I seen any uncomplicated fever that could not be directed to a speedy and favourable termination by these simple means, or I should say *apparently* simple, for their action is, in truth, as complicated as they themselves are homely. Any one who has heard Hughes Bennett state his ideas about emetics, will remember the great importance he attached to them in warding off an attack of fever, and his speculations as to the action of this class of remedies. In many works on practice of medicine, one reads to the following effect, "an emetic at the commencement, *to unload the stomach,* will prove of great service," but I fancy that in very few cases at the commencement of fever will the stomach be found in a loaded condition. It is very certain that the principal action of an emetic is not attributable to the mere fact of its unloading the stomach, and it is as certain that the hot-bath does not act by making a person hot. Both however do act powerfully on the nervous system, emetics probably through the pneumo-gastric, solar plexus and splanchnic nerves, and the hot-bath through the branches of the sympathetic to the periphery. I have frequently seen patients in the cold stage of ague, within a few minutes of taking a warm mustard emetic, streaming with perspiration, and almost immediately confessing themselves greatly relieved; although the emetic by itself will almost surely so affect the nervous system as to produce diaphoresis, diuresis, &c. The hot-bath should by no means be omitted, and should be the first step in the treatment, because in the first place, it is so agreeable to the patient, and in the second, on account of its action on the nervous system. The bath should be of a warmth comfortable for the patient to get into at once, and the water should cover the whole trunk and nape of the neck; if the water be too hot, injury is done to the patient by having his skin exposed to the air while making efforts to immerse himself; if the water is agreeably warm at first, as the patient gets accustomed to it, he can bear to have the temperature considerably increased by the addition of hot water after immersion. The bath should not be far from the patient's bed, as the patient will probably feel faint on standing up. He should remain in the bath till a gentle perspiration appears on the forehead, hot water being constantly added as the temperature of the bath falls; an attendant should pour the water over the head with a tin pot, and be ready with a large towel roughly to dry the patient, who should go at once between *blankets*, and have the emetic. I have generally used mustard, a table-spoonful (for an adult) in a large tumbler full of warm water, followed by warm water till free vomiting takes place. Tartar emetic, Ipecacuan, or other remedies of that class, cause unnecessary depression and nausea. This treatment may require to be repeated, but with the ordinary cases I have seen, it has been seldom required. A tonic may afterwards be given if necessary, and I have used iron, strychnia, quina and bitter infusions; when, however, I have given quina, it has not been on account of its so called anti-periodic virtues, but as a nervine tonic. In reading the treatment of the older physicians, where it was calomel, tartar emetic, and bleeding "to 10 lbs," one can only hope that the disease has undergone a change of type, which however I doubt, and I think I can see even in their treatment that, at an enormous cost, they would obtain what they might have accomplished by the emetic and bath, viz., the desired relaxation of the nervous system. Who can doubt but that after a bleeding of "10 lbs.," there would be both profound relaxation and depression; and I fancy that both were at times greater and more lasting than desired, the remedy proving considerably worse than the disease.

In conclusion, I think that if the theory that irritation of the sympathetic is the cause of fever be correct, by carefully studying the physiology of that system with regard to its connection with the capillaries, we shall at length be able to do something towards solving the difficulty which attaches to the pathology of that condition of the spleen known as ague cake, which is so frequent a result of repeated attacks of fever; and I would venture to suggest also, that perhaps the pathology and treatment of the disease we call sun-stroke may be indicated and rendered less obscure by the same direction of study.

What I have principally intended to set forth in the above notes is, as it appears to me, the unnecessary trouble we have been at, if not the error we have fallen into, in going abroad seeking for specific poison, malaria, &c., wherewith the blood might become contaminated so as to re-act "on every tissue of the body," and give rise to the condition known as fever, thereby misleading ourselves as to the true origin and sequence of the phenomena; whereas, I think that our knowledge of great facts in Anatomy and Physiology is of itself sufficient to account for all the morbid symptoms, without the introduction of words coined to escape from a difficulty, or at any rate, to express a something (?) which has never been shown to exist.

These notes I readily confess to be both immature and hurried, but being the result of some thought and study, I humbly offer them as suggestions for the consideration of any of your readers interested in the subject, and should consider that they had more than accomplished their end if they gave rise to any discussion whereby the present unsatisfactory state of our pathology could in any degree be lessened; while at the same time I should be glad to be put right by those better acquainted with the subject than myself, if I have allowed an incorrect theory to take too great a hold of my mind.

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